

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: Not yet assigned

Filing Date: Herewith

Applicant: MIWA, et al.

Group Art Unit: Not yet assigned

Examiner: Not yet assigned

Title: LIQUID CYRSTAL DISPLAY DEVICE,
MANUFACTURING METHOD THEREFORE,
AND ELECTRONIC APPARATUS

Attorney Docket: 9319S-000212

Hon. Commissioner of Patents and Trademarks
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to the examination of this application, please amend it as follows:

IN THE SPECIFICATION

[0013] As shown in Fig. 14, in an internal scattering liquid crystal display device 5C, the surface of a backside substrate 51 at a liquid crystal 54 side is roughened. That is, a plurality of minute protrusions and a plurality of minute recesses are formed on the surface described above. A reflective layer 517 is formed on this roughened surface. Accordingly, on the surface of the reflective layer 517, protrusions and recesses are

formed in conformity with the protrusions and recesses formed on the surface of the roughened surface.

[0034] In addition, in order to achieve the objects described above, an electronic apparatus of the present invention comprises one of the liquid crystal display devices described above. As described above, since superior display characteristics can be obtained by this liquid crystal display device, it is preferably used as a display device for various electronic apparatuses.

[0039] Each manufacturing method described above preferably further comprises, after the step for forming the roughened area, a step of removing the mask material and a step of etching the area which is previously covered with the mask and the roughened area. By the etching described above, the shape of the roughened area can be controlled to have a predetermined shape. In the step described above, when etching is performed before the mask material is removed, a problem may arise in that the difference in height between the roughened area and the flat area is increased. As a result, when the difference in height exceeds a predetermined cell gap of the liquid crystal display device, the substrate cannot be used for the liquid crystal display device. On the other hand, when etching is uniformly performed on the roughened area and the flat area after the mask material is removed, advantage can be obtained in that the increase in difference in height between the two areas can be suppressed.

IN THE CLAIMS

Please amend claims 3-5 and 9 in accordance with the following rewritten claims in clean form. Please add new claims 10-17. Applicant includes herewith an Attachment for Claim Amendments showing a marked up version of each amended claim.

3. (Amended) The liquid crystal display device according to Claim 1, wherein the reflective layer has a plurality of apertures therein.

4. (Amended) The liquid crystal display device according to Claim 1, further comprising a color filter layer and a protective layer protecting the color filter, which are provided between the reflective layer and the alignment film and in the roughened area of said one of the substrates.

5. (Amended) An electronic apparatus comprising a liquid crystal display device according to Claim 1.

9. (Amended) The method for manufacturing a liquid crystal display device, according to Claim 6, further comprising a step of removing the mask material after the step of forming the roughened area is performed, and a step of etching the flat area and the roughened area.

10. (New) A liquid crystal display device comprising:

a front substrate and a backside substrate bonded together by a sealing material;
a liquid crystal disposed between said front and backside substrates;
a first alignment film formed on a liquid crystal side of said front substrate;
a second alignment film formed on a liquid crystal side of said backside substrate;

a surface of said backside substrate is composed of a flat area peripherally surrounding an area that contains a plurality of protrusions and recesses, wherein said second alignment film is disposed within said area that contains said plurality of protrusions and recesses and said sealing material is formed on said flat area; and
a plurality of spacers dispersed between said first and second alignment films.

11. (New) A liquid crystal display device according to Claim 10, wherein a reflective layer, an insulating layer and a color filter layer are disposed on said backside substrate on said area that contains said plurality of protrusions and recesses.

12. (New) A liquid crystal display according to Claim 11, wherein said reflective layer contains a plurality of apertures therein.

13. (New) A liquid crystal display device according to Claim 10, wherein a transfective layer, an insulating layer and a color filter layer are disposed on said backside substrate on said area than contains said plurality of protrusions and recesses.

14. (New) A liquid crystal display according to Claim 13, wherein said transfective layer contains a plurality of apertures therein.

15. (New) A liquid crystal display device according to Claim 10, further comprising a light source.

16. (New) A liquid crystal device comprising:
a liquid crystal disposed between a front substrate and a backside substrate;
a polarizer, a retardation plate, a plurality of pixel electrodes, a plurality of scanning lines, and a first alignment film disposed on said front substrate;
said backside substrate is composed of a flat area peripherally surrounding an area containing a plurality of protrusions and recesses;
a reflective layer, an insulating layer, a color filter layer, a protective layer, a plurality of transparent electrodes, and a second alignment film disposed on said area containing a plurality of protrusions and recesses;
a sealing material disposed on said flat area of backside substrate; and
a plurality of spacers disposed between said first and second alignment films.

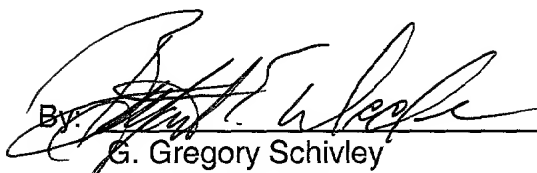
REMARKS

The purpose of this preliminary amendment is to clarify the translation, remove multiple dependent claims and add new claims.

Favorable consideration of this application is respectfully requested.

Respectfully submitted,

Dated: September 17, 2001

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ATTACHMENT FOR SPECIFICATION AMENDMENTS

Attorney Docket No. 9319S-000192

(underlines indicate insertions and brackets indicate deletions)

[0013] As shown in Fig. 14, in an internal scattering liquid crystal display device 5C, the surface of a backside substrate 51 at a liquid crystal 54 side is roughened. That is, a plurality of minute protrusions and a plurality of minute recesses are formed on the surface described above. A reflective layer 517 is formed on this roughened surface. Accordingly, on the surface of the reflective layer 517, protrusions and [recess] recesses are formed in conformity with the protrusions and recesses formed on the surface of the roughened surface.

[0034] In addition, in order to achieve the objects described above, an electronic apparatus of the present invention comprises one of the liquid crystal display devices described above. As described above, since superior display characteristics can be obtained by this liquid crystal display device, it is [preferable] preferably used as a display device for various electronic apparatuses.

[0039] Each manufacturing method described above preferably further comprises, after the step for forming the roughened area, a step of removing the mask material and a step of etching the area which is previously covered with the mask and the roughened area. By the etching described above, the shape of the roughened area can be controlled to have a predetermined shape. In the step described above, when etching is performed before the mask material is removed, a problem may [be] arise in that the difference in height between the roughened area and the flat area is increased.

As a result, when the difference in height exceeds a predetermined cell gap of the liquid crystal display device, the substrate cannot be used for the liquid crystal display device. On the other hand, when etching is uniformly performed on the roughened area and the flat area after the mask material is removed, advantage can be obtained in that the increase in difference in height between the two areas can be suppressed.

[0090] The reflective layer 111, the insulating layer 112, the color filter layer 113, the protective layer 114, and the alignment film 116 are formed in the roughened area 11b on the backside substrate 11. The formations mentioned above are described below in detail. In this embodiment, as shown in Fig. 1, the periphery 22 of the protective layer 114 is located outside (that is, the sealing material 13 side) the periphery 21 of the reflective layer 111. In addition, the alignment film 116 is formed over the surface of the protective layer 114. Accordingly, among the elements formed on the backside substrate 11, the periphery 22 of the protective layer 114 is located at the outermost place when observed from the front substrate 12 side. In addition, as shown in Fig. 1 [3], the protective layer 114 is formed so as to be in the roughened area 11b of the backside substrate 11. Accordingly, the reflective layer 111, the insulating layer 112, the color filter 113, the protective layer 114, and the alignment film 116 are all formed in the roughened area 11b. In other words, the elements formed on the backside substrate 11 do not extend over the step formed at the boundary 23 of the flat area 11a and the roughened area 11b. As shown in Fig. 1, an area from the inside periphery of the sealing material 13 to the pixel located at the outermost place among the pixels aligned in a matrix is a non-display area 25, and an area inside the non-

display area 25 is the display area 24[26]. Accordingly, as it is understood from a boundary 26 shown in Fig. 3, the entire display area 24[26] is formed in the roughened area 11b when observed from the front substrate 12 side.

roughened area 11b

ATTACHMENT FOR CLAIM AMENDMENTS

Attorney Docket No. 9319S-000212

(underlines indicate insertions and brackets indicate deletions)

3. (Amended) The liquid crystal display device according to Claim 1 [or 2], wherein the reflective layer has a plurality of apertures therein.
4. (Amended) The liquid crystal display device according to [one of Claims] Claim 1[to 3], further comprising a color filter layer and a protective layer protecting the color filter, which are provided between the reflective layer and the alignment film and in the roughened area of said one of the substrates.
5. (Amended) [The] An electronic apparatus comprising a liquid crystal display device according to [one of Claims] Claim 1 [to 4].
9. (Amended) The method for manufacturing a liquid crystal display device, according to [one of Claims] Claim 6 [to 8], further comprising a step of removing the mask material after the step of forming the roughened area is performed, and a step of etching the flat area and the roughened area.